

BAT HIBERNACULUM SEARCH IN THE
PRYOR MOUNTAINS, *23*
SOUTH-CENTRAL MONTANA,
~~FEBRUARY AND MARCH, 1992~~ *2*

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Cover photo: Mark Madson at the entrance to Little Ice Cave, March 20, 1992. Photo by Greg Hanson.

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EXECUTIVE SUMMARY

1987 (Gunter 1988, W&R '90
W'91

This report documents the results of a study of bat habitat in the Pryor Mountains of south central Montana and represents a continuation of studies begun in 1987 (Worthington and Ross 1990, Worthington 1991). Field work conducted from February through May 1992, included visits to caves and abandoned mines in the study area. A search of these resources for signs of bat habitation produced a census of hibernating bats and a record of temperature and humidity readings.

MARCH

A total of eighteen caves and six mines were visited during the study. Populations of hibernating bats were identified and counted. An effort to collect temperature, relative humidity, survey and bat count data produced a series of cave maps defining a portion of the available bat habitat in the Pryor Mountains.

Many of the larger caves in the area contained winter populations of the Western Big-Eared bat, Plecotus townsendii, and Myotis sp.. This indicates that the study area provides important year-round roosting habitat for bats. A number of the smaller caves were unusable as winter hibernacula and many of these could not be entered because of snow.

Myotis spp. not suitable for

Plecotus townsendii

INTRODUCTION

There are 14 species of bats found throughout Montana (Thompson 1982; see Figure 1, Appendix A). Of these, 10 species are known to inhabit the Pryor Mountains mid-spring to mid-fall (Shryer-Flath 1980, Worthington and Ross 1990, Worthington 1991). These are indicated in Figure 1 (Appendix A). Few winter season studies of bat occurrence in the area have been attempted.

For this study a hibernaculum search was conducted within caves and mines of the Pryor Mountains area with a principal objective of obtaining a bat census and also temperature and humidity readings in as many caves as possible, whether bats were present or not. The primary purpose being to determine suitable hibernaculum environment and possible future winter roost sites. The main concern here was identification and count of Plecotus townsendii, as this bat is currently listed as a sensitive species of special concern by the Forest Service - Region 1 and the Montana Natural Heritage Program. Bats are already known to inhabit caves in the Pryor Mountains region during the winter (Worthington 1991). Prior to this study no complete winter census exists.

Disturbance of bats in the hibernation state can cause a metabolic increase which would burn up bodily fat reserves needed for survival through the winter. Without a management plan providing protection for sensitive species, unregulated disturbance could cause an irreversible loss of suitable habitat and species population.

The Federal Cave Protection Act of 1988 requires Federal agencies to identify and manage significant cave habitat for threatened and endangered species. Information gathered from this study will assist in management of the Pryor Mountain area and help evaluate the current status of the resource.

METHODS

Caves were located and identified from previous field work and contact with local authorities. Inventory information collected from visits to the caves was recorded for resource management evaluation. USFS Cave Inventory forms were completed but should not be considered final. These surveys lack, in particular, paleontological, archaeological and biological details beyond the scope of this study.

If bats were discovered, psychrometer readings were taken as close to each roost as possible without disturbing. Basic plan and profile maps with bat locations and temperature/humidity readings are included in Appendix A. Bats were then counted and species determined if possible using an identification key (Barbour and Davis 1969).

Plecotus townsendii is rather easy to identify. However, Myotis varieties can be difficult to tell apart without previous handling experience. In many cases, an experienced bat biologist must identify a specimen. Both count and identification of Myotis proved challenging due to a number of limiting factors. In the case of Mystery Cave, many clusters roosting too far from reach to obtain an accurate count were estimated using diameter times average body volume to arrive at an estimate of numbers.

Some caves were surveyed and maps produced when no cartographic representations were available. Some available maps proved to be misleading or lacked detail in which case notes and sketch corrections made and included in this report.

Finally a variety of photographs were taken. Some accompany this report, the rest were submitted in slide form to the Nature Conservancy.

STUDY AREA

General Description

The Pryor Mountains lie in south-central Montana near the Wyoming border (Figure 2, Appendix A). The range consists of four major mountain blocks. The two northernmost blocks are located on the Crow Indian Reservation and are closed to trespassing by non-tribal members. Our field search for the purposes of this study was limited to an area of about 140 square miles outside the reservation, which includes the two southernmost mountain blocks, Big Pryor Mountain and East Pryor Mountain. Also included in this area is Red Pryor Mountain, which is physically a southern extension of Big Pryor Mountain. The lands within the study area are public lands administered by the BLM and USFS.

Big Pryor Mountain and East Pryor Mountain consist of 2 flat topped blocks which slope gently on the south and west sides, and drop off steeply on the north and east sides. These mountains are dissected by many rugged canyons, the majority of which occur on the gentler southwestern slopes, and trend southwest to northeast. These canyons are typically several hundred feet deep, and are rimmed with limestone cliffs along the top edges.

Elevations in the Pryor Mountains range from 4,000 feet at the southern end to 8,800 feet at the tip of east Pryor Mountain and Big Pryor Mountain. This elevation difference makes for a wide range of precipitation and vegetation types. The lowest elevations are very dry and usually remain free of snow throughout most of the winter months. These areas are desert or semi-desert and vegetation here is mainly grass, juniper, sage, and cedar and associated plants. Much of the Pryors at intermediate to high elevations receive enough annual precipitation to support thick forests of pine, fir, and spruce. The highest elevations are typically devoid of timber and are characterized by alpine tundra type flora. Several feet of snow may accumulate at the highest elevations in an average winter.

Geology

Nearly all the exposed surface rock in the study area is Madison Group limestone. Total thickness of Madison Limestone in the Pryors averages over 700 feet (Campbell 1978, Denson and Morrissey 1955, Richards 1955). Geology of the study area has been described in great detail in the literature (Richards 1955, Blackstone 1940, Campbell 1978, Shaw 1955). Deformation beginning in Tertiary time and continuing through early Quaternary formed the mountains of the area by uplift and normal faulting (Thom and others 1935). The Pryor Mountains are a series of anticlines assymetrically deformed to form four major mountain blocks. The study area included two of these, the Red Pryor Mountain (or Big Pryor Mountain) block and the East Pryor Mountain block.

Cave development in the study area occurred principally in the Mission Canyon Formation. This Mississippian age limestone

contains many fossils and is capped by a layer of solution breccia over much of the Pryor Mountains area. Campbell has noted that most of the caves in the Pryors occur in the upper 100 feet of the Mission Canyon Formation and often near the contact between the solution breccia and a very fossiliferous layer of limestone beneath it (Campbell 1978).

A red clay fill blocks passages in many of the caves in the area. Evidence indicates that it was washed in from the overlying Amsden Formation, and later was partially excavated during the Tertiary uplift (Elliot 1963, Shultz 1969).

Water solution processes provided the primary mechanism for cave development for all the caves in the study area, with the possible exception of Frogg's Fault Cave. Frogg's Fault is believed to be the result of a combination of solution and gravity sliding (Campbell 1978).

The climate and character of the area has produced an abundance of caves. These fall into two different categories. The most common are pit caves with little or no side passages. They provide little protection against the winter weather and are mainly used by wildlife in the summer months. The second type include solution cavities and caves with extensive horizontal passage development. These provide the most important winter habitat for bats, where a thermally stable environment is maintained throughout the winter.

RESULTS

Caves in the Study Area

Caves in the Pryor Mountains were found throughout the elevation range, with the lowest known significant cave being Four-Eared Bat Cave at 5040 feet, and the highest known significant cave being Crater Ice Cave at 8690 feet. The tops of Big Pryor Mountain and East Pryor Mountain contain areas of alpine karst with many sinkholes and other karst features. Most of these sinkholes are steeply vertical in nature, less than 100 feet deep, and contain little or no connected passage. Many of these sinks were not explored during this study. Nearly all of the high elevation cave entrances are covered with drifted snow in the winter, making access impossible.

Many of the known caves in the area were visited during this study. Maps of the caves we surveyed and others available from previous work are included in Appendix A. Time limitations prevented the complete survey of all the caves. Field Cave Inventory forms for some of the caves visited are contained in Appendix B. These forms were provided by the US Forest Service (USFS) and provide data to evaluate the resource potential of the subject cave.

The majority of the known significant caves in the Pryors have been found along the southwest sloping flanks of the mountains, at low to intermediate elevations. The caves are widely scattered and may have either horizontal or vertical entrances. Some of these caves are extensive, with the longest known being Little Ice Cave with over 4,000 feet of passage. Mystery Cave is the second longest at around 1,800 feet of passage. The deepest known cave in the Pryors is Frogg's Fault at -271 feet. A few of the higher caves, most notably Little Ice Cave and Big Ice Cave, develop some impressive ice speleothems during the winter months. These ice speleothems melt during the heat of summer. Several caves are known to contain permanent deposits of ice. The most notable examples include Big Ice Cave, Little Ice Cave, Crater Ice Cave, and Red Pryor Ice Cave.

For the most part, caves in the study area were rather dry and devoid of speleothems, the major exceptions being Mystery Cave and Frogg's Fault, both of which contain several well decorated areas. Many of the caves contain organic debris and droppings and are used by a variety of animals for shelter.

Cave Descriptions

NAME: Four-Eared Bat Cave
LOCATION: Sec.27, T.9S, R.28E
USGS QUAD: Mystery Cave, MT - 7½'
LAND OWNERSHIP: Bureau of Land Management
ELEVATION: 5,040 feet

At 5,040 feet, Four-Eared Bat Cave was the lowest cave visited for this study. The cave entrance consists of an opening 3 feet high by 25 feet wide, at the bottom of a sink on a southwest trending ridge. The location is indicated on the USGS 7½' quadrangle map. A BLM sign at the entrance has the cave's name on it. The cave is dry with only a very small area of speleothem growth near the end of the lower level.

The entrance opens into a 120 feet wide by 200 feet long room with large blocks of breakdown on the floor (See Figures 3 and 21, Appendix A). Leading southwest from this room, a passage leads down into the lower level of the cave. The main part of this lower level consists of a room 50 feet high by 300 feet long. This room has a very flat, sandy floor and ceiling heights of up to 12 feet. At the end of this long room is another room 50 feet wide by 60 feet long, 12 feet high.

The name Four-Eared Bat Cave refers to the Plecotus townsendii bats which inhabit the cave. Early settlers to this area mistook the prominent tragus on the ears of the Plecotus for an extra set of ears, thus thinking the bats had four ears instead of two (Personal communication with Mrs. Royce Tillet).

Four-Eared Bat Cave was first visited by the authors on February 26, 1992. The cave temperature about 20 feet inside the entrance was 50° F and the relative humidity was 53%. A number of bats were observed roosting in the cave (Figure 3, Appendix A). The total number of bats observed was 18. Fifteen of these were Plecotus townsendii, and three were Myotis sp. Five of the 15 P. townsendii were near the southeast wall of the large entrance room (Figure 3). The bats were hanging from the ceiling in an open, exposed area at an average height of 7 to 8 feet above floor level. The temperature here was 45° F and the relative humidity 61%.

Four Plecotus townsendii were found further in the cave along the same wall (Figure 3, Appendix A). Two were roosting on the ceiling at a height of about 6 feet above the floor, and two others were roosting on the wall, one about five feet above the floor, and the other at about 4 feet above the floor. Temperature here was 44° F and relative humidity was 73%.

Six more Plecotus townsendii were found hanging on the ceiling

in the passage between the upper and lower levels (Figure 3, Appendix A). The average roosting height above the floor for this group was six feet. Here the temperature was 45° F and relative humidity was 67%.

The Plecotus townsendii we observed tended to be in diffuse groups (Figure 3, Appendix A). They were not roosting in tight clusters as do Myotis sp.. All the P. townsendii we saw were hanging singly, separated from each other by distances ranging from 2 inches to several feet. No Plecotus were observed in the lower level of the cave.

Of the Myotis sp. found, two were roosting on the ceiling near the lowest point of the large entrance room. They were about 12 feet above the floor. Temperature near them was 46° F with 62% relative humidity. A third Myotis sp. was observed in the main lower level room, also hanging from the ceiling at a height of about 12 feet. The temperature below the roost was 50° F with 70% relative humidity. This was the only bat seen in the lower level.

In addition to bats, we found a Prairie Rattlesnake (Crotalus viridis viridis) in an alcove on the south side of the main entrance room. It was coiled up on a small ledge, presumably wintering there. We estimated this snake to be about 3 feet in length. The snake seemed to be fairly alert and had probably been awakened by our presence. This was the only snake observed by us in any of the Pryor Mountains caves.

We visited Four-Eared Bat Cave again on March 9, 1992. The purpose of this trip was to survey the cave to construct a map. We decided to map the cave because we were unable to locate an existing map, and because it is the fourth largest known cave in the Pryor Mountains and a significant bat hibernaculum. We surveyed a total horizontal length of 792 feet.

The cave was also checked again for bats on this trip. All the Plecotus townsendii seen on the February 26 trip were found to be in the same locations as before, however two out of the three Myotis sp. had moved elsewhere. We were unable to relocate these two M. sp.. Either they moved to a more inaccessible spot in the cave or chose to find a different hibernaculum. Movement to another cave would not be out of the question, as daytime temperatures during the period between our two visits to Four-Eared Bat Cave averaged in the 50's and 60's °F.

We feel that the bat counts made in Four-Eared Bat Cave were as accurate as possible since nearly all areas of the cave can be clearly seen and checked. However, there are a few spots with high ceilings and other inaccessible areas.

NAME: Syke's Cave

LOCATION: Sec.22, T.9S, R.28E

USGS QUAD: Mystery Cave, MT - 7½'

LAND OWNERSHIP: Bureau of Land Management

ELEVATION: 5,700 feet

The entrance to Syke's Cave is an opening 8 feet high and 12 feet wide on the west side of a small southwest-northeast trending canyon. The cave opening lies at the base of a small cliff and is marked by a wooden BLM sign. The cave location is marked on the USGS 7½' quadrangle map.

Syke's Cave is not a pleasant cave to visit. The cave is very dry and dust is stirred into the air as one moves through the cave. Once inside the entrance, the cave opens into a room 30 feet wide by 30 feet long, 12 feet high. From here, a walking passage leads to the northwest and ends in a dome room 12 to 15 feet high. The main passage of the cave continues from the northeast side of the entrance room and consists of approximately 350 feet of crawlway with an average ceiling height of 2 to 4 feet. In addition to the dust, the floor is covered with pack rat (Neotoma cinerea) droppings and cactus spines.

Total horizontal length of the cave is about 450 feet. We entered Syke's Cave and checked it for bats on February 26, 1992. Speleothems in the cave are limited to very small amounts of flowstone. Temperature and relative humidity in the entrance room were 50°F dry bulb (db) and 65%. Figure 4 (Appendix A) is a map of the cave showing major features of the cave.

Only a single bat was seen in Syke's Cave. This was a Myotis sp. roosting on the ceiling of the main crawlway at a height above the floor of about 3 feet. This bat was about 150 feet into the cave from the entrance. Temperature and relative humidity here were 52°F and 66%.

Two possible reasons for the lack of bats in this cave are the low ceiling height in most of the cave, combined with the fact that the cave consists mainly of a single passage. Bats roosting here would be very vulnerable to predators.

NAME: Four by Four Cave

LOCATION: approx. Sec.21, T.9S, R.28E

USGS QUAD: Mystery Cave, MT - 7½'

LAND OWNERSHIP: Bureau of Land Management

ELEVATION: 5,450 feet

There seems to be a great deal of confusion regarding this cave. We were unable to locate a cave that matched the existing map of Four by Four Cave after two days of searching. Several conflicting descriptions exist as to the location of this cave. The location is marked on the USGS 7½' quadrangle map, but this placement appears to be inaccurate. Worthington claims to have checked this cave for bats in the summer of 1989 (Worthington and Ross 1990), but may have confused it with Little Sink Cave which is in the same vicinity. The small reported size of both Four by Four Cave and Little Sink Cave (Campbell 1978) make the use of either cave as a hibernaculum very unlikely, because of thermal instability.

NAME: Frogg's Fault Cave

LOCATION: Sec.16, T.9S, R.28E

USGS QUAD: Mystery Cave, MT - 7½'

LAND OWNERSHIP: Shown as State school section 16 on maps,
administered by Bureau of Land Management

ELEVATION: 6,020 feet

Frogg's Fault is one of the most impressive caves in the study area. It is the deepest known cave in the Pryor Mountains, reaching a maximum relief of -271 feet and is also the third longest cave in the Pryors with about 1254 feet of mapped passage. This cave contains some of the best speleothems in the Pryors and a significant population of bats. The location of the cave is marked on the USGS 7½' quadrangle map.

The entrance to Frogg's Fault is a vertical sink 15 feet wide and 20 feet long. It is located about 50 feet west of the top of a southwest trending ridge, on the edge of a patch of small to medium sized Douglas Fir (Pseudotsuga taxifolia).

Exploration of this cave requires technical caving gear and knowledge of vertical caving techniques. The entrance pit is a 40 foot free rappel. At the bottom of this drop, the cave trends steeply downward for about 60 feet to the edge of another 40 foot pit. Most of this pit is also a free drop. At the bottom of the second pit the cave splits into two directions, one heading northeast, and the other southwest. The passage heading southwest is not shown on Campbell's map (Campbell 1978) and contributes a significant amount of passage length. Hereafter in this report, this section of the cave will be known as the 'new' section. The portion of Frogg's Fault shown on the map in Campbell's book will be known in this report as the 'old' section (See Figures 17 through 20, Appendix A).

Frogg's Fault is described by Campbell as being 766 feet in length and -261 feet in depth (Campbell 1978). During this study we surveyed and mapped another 508 feet of length in the 'new' section and reached a slightly greater depth. This brings the total length of Frogg's Fault to approximately 1254 feet. The depth of the cave was extended to -271 feet.

At the bottom of the second 40 foot pit, where the cave splits, the 'old' section of the cave continues downward in a northeasterly direction. A 20 foot pit must be negotiated almost immediately (rope required). At the bottom of this pit, the cave becomes a narrow (6 to 20 foot wide) fissure with high ceilings. This fissure extends to the northeast for several hundred feet. In this part of the cave ceiling heights vary quite a bit, from 8 to more than 100 feet. There are massive breakdown blocks on the floor and wedged into the fissure overhead. This part of the cave is rather dry, but does contain some interesting speleothems in

places, including popcorn, (coralloidals) folia, blisters, and small stalactites.

The 'new' section of Frogg's Fault Cave had probably been explored before, but we found no signs of previous human visitation. This section of cave is reached by heading southwest from the bottom of the second 40 foot pit. A climb up and over a massive breakdown pile reveals the brink of a long and narrow pit which is 65 feet deep. This pit requires rope for descent. Beyond this point, the cave becomes considerably wetter with large amounts of flowstone and other speleothems. A fair amount of water drips down into this pit.

At the bottom of the 65 foot pit the cave again becomes a large fissure with ceiling heights varying considerably. The width of the fissure averages about 10 feet. This fissure trends southwestward for 287 feet from the bottom of the 65 foot pit. There are no side passages and ceiling heights are difficult to estimate. Speleothems are fairly abundant throughout this area. At survey station 3 (see Figure 18, Appendix A) are nice soda straws and large inactive draperies. Other areas along this passage contain good examples of flowstone.

During the course of this study we made two trips into Frogg's Fault. The first trip was on February 28, 1992. We explored the 'old' section of cave, then, while checking leads, found the 65 foot pit and the 'new' section. This 'new' section was not explored on the first trip due to lack of rope. The second trip into the cave was on March 15, 1992. We then descended the 65 foot pit, explored the cave to its end and surveyed back out.

Frogg's Fault Cave appears to be an important hibernaculum for Plecotus townsendii. On the first trip into the cave (February 28, 1992), ten P. townsendii were observed in the cave (Figure 17, Appendix A). We feel there were undoubtedly more P. townsendii which could not be seen because of the abundance of inaccessible areas available. The ten P. townsendii that we did observe were found near the lowest part of the 'old' section of cave. The bats observed were roosting in the open, at an average height of 7 to 8 feet above the floor. There were two separate groups of three Plecotus, and one group of four. Again, these were not tight clusters. The temperature in this area was 44 to 45° F and relative humidity about 90%. No Myotis sp. were observed in the 'old' section.

The 'new' section of the cave was home to at least six Myotis sp. However, there were probably more bats here which could not be seen due to inaccessibility of many areas. The 'new' section of the cave was checked for bats during the survey trip on March 15, 1992. Two Myotis sp. were roosting on the ceiling just above the top of the 65 foot pit. Of these two, one was completely covered with small water droplets. These two bats were at a height of about 8 feet above the floor. Temperature and relative humidity at this location were not measured. Four Myotis sp. were seen in the lower level below the 65 foot pit. These four bats were roosting on open areas of ceiling at heights varying from 6 to 20 feet above the floor. While conducting our survey, three of these Myotis were

disturbed by our talking and movement, and became quite agitated. The temperature in this area was 45° F, and the relative humidity 91%. No Plecotus townsendii were observed in the 'new' section of Frogg's Fault Cave.

NAME: Royce Cave

LOCATION: Sec.6, T.9S, R.28E

USGS QUAD: Mystery Cave, MT - 7½'

LAND OWNERSHIP: Bureau of Land Management

ELEVATION: 6,160 feet

The entrance to Royce Cave is located in the bottom of a large sink measuring 60 feet wide by 90 feet long and 20 feet deep. There are several mature Douglas Fir trees (Pseudotsuga taxifolia) growing inside the sink. The cave entrance is an 8 foot wide, 5 foot high opening on the north side of this sink, and its location is marked on the USGS 7½' quadrangle map.

Mr. and Mrs. Royce Tillet, early settlers in the area, were the first whites to discover the cave. They were riding horseback around the south edge of the large sink, when they reached a point where the horses balked and refused to go further. Upon closer investigation, they saw that the ground upon which they were standing, which appeared at first to be solid ground, was actually the thin arch of limestone (2 feet in thickness) which makes up the roof of the entrance to "Rolls" Cave directly below. After checking the area further, they found the entrance to Royce Cave, but did not actually explore the cave until several years later. (Personal communication with Mrs. Royce Tillet)

Royce Cave consists of 100 feet of walking passage, averaging 5 feet wide and 6 feet high, leading north into a large room, 100 feet wide and 180 feet long. This room has ceiling heights which vary from 8 to 50 feet and is quite impressive. The center of this room contains a massive pile of breakdown containing a maze of areas in between the individual blocks which simulate additional cave passage. Figure 5 (Appendix A) is a sketch map of the cave.

There appears to be periodic water flow into Royce Cave. Most of the entrance passage is floored with sand and silt, with water flow patterns clearly visible. Along the lowest point of the west wall of the main room there is quite a bit of organic debris (sticks, grass, pine needles, etc.) which has washed into the cave. Waterlines around the edges of what were recently pools of standing water can be seen here.

The lower parts of this room inside the breakdown contain some very large calcite crystals (spar). Smaller calcite crystals are also common in other parts of the room. Other speleothems in the main room include limited quantities of stalactites, stalagmites and flowstone around the room's perimeter.

Another 60 feet of side passage extends off from the east side of the main room. This passage averages 8 feet wide by 5 feet high, and contains scattered areas of small speleothems (mainly calcite crystals).

The authors entered Royce Cave twice, first on March 1, 1992,

and later on March 14, 1992. We recorded the temperature and relative humidity of the main room at 48° F and 100%. About 20 feet inside the cave entrance the temperature was 45° F and the relative humidity was 100%. No bats were observed on either date.

The vast majority of bats we found in other caves during this study have been roosting where the temperature was 45° F less. This may help explain why there was only one bat in Syke's Cave (52° F) and only one bat in the lower level of Four-Eared Bat Cave (50° F). Another possible explanation is that bats may have been roosting in the higher reaches of the ceiling of the main room, where there are many areas that cannot be seen or accessed from the floor of the cave.

Apparently, Royce Cave receives summertime use by bats, as Worthington captured 75 bats here on seven different nights during the summer of 1990 (Worthington 1991). We did observe some bat droppings in the cave, which indicated at least some seasonal use.

On the south side of the sink containing ~~Syke's~~ ^{Royce} Cave another cave entrance leads to a cave 281 feet long, which to the best of our knowledge, has not been previously described anywhere. We explored, surveyed and mapped this cave, naming it "Rolls" Cave.

NAME: "Rolls" Cave

LOCATION: Sec.6, T.9S, R.28E

USGS QUAD: Mystery Cave, MT - 7½'

LAND OWNERSHIP: Bureau of Land Management

ELEVATION: 6,160 feet

The entrance to "Rolls" Cave is on the south side of the same sink that contains the entrance to Royce Cave. The main cave entrance consists of a horizontal opening about 15 feet wide by 5 feet high. In addition, two small sinkholes from the surface penetrate the roof of the cave near the entrance. At this point the thickness of the cave roof is only about 2 feet. This passage has a gradually lowering ceiling which drops down to a height of 10 inches before opening up again into a large room. This room is 150 feet long by 20 feet wide with average ceiling heights varying from 3 to 7 feet. There is also a small dome which reaches a height of 12 feet. The floor throughout the cave is dry and dusty with little breakdown. The only speleothems observed were a few very small stalactites.

We believe that before our exploration, the majority of the cave had seldom, if ever, been visited by humans. We saw no evidence of visitation (footprints, etc.) and inside the first part of the cave, the passage appears to dead-end after about 50 feet. You must squeeze through about 30 feet of very tight and dusty crawlway (ceiling height 10 inches) before entering the main cave. Most people would look at this and assume it was a dead end.

We entered "Rolls Cave" twice, first on March 1, 1992, and again on March 14, 1992. The first trip was the initial finding and exploration of the cave, while the second trip was dedicated to surveying and mapping. We surveyed "Rolls Cave" to a total length of 281 feet (Figure 22, Appendix A). Temperature and relative humidity readings were 48° F and 97%. No bats or bat sign were observed.

NAME: "Premonition Cave"

LOCATION: Sec.6, T.9S, R.28E

USGS QUAD: Mystery Cave, MT - 7½'

LAND OWNERSHIP: Bureau of Land Management

ELEVATION: 6,140 feet

The entrance to "Premonition" lies at the base of a 5-foot-high limestone outcrop on a rocky, southwest-trending ridge. The cave is about 200 yards southwest of the large sink containing the entrances to "Rolls" and Royce Caves. Vegetation near the entrance is composed chiefly of sage (*Artemisia* sp.) and juniper (*Juniperus* sp.). The entrance to "Premonition Cave" is quite small and does not look like it would lead into anything significant. It would be very easy to miss for someone who had not been there previously.

We discovered, completely explored and surveyed "Premonition Cave" on March 14, 1992. The total surveyed length of the cave is 178 feet (Figure 13, Appendix A). The cave entrance consists of a low horizontal slit 14 inches high by 12 feet wide. After crawling into the entrance, there is a belly crawl for a distance of about 40 feet before the cave opens up to a hands and knees crawlway. The rest of the cave consists mainly of wide hands and knees crawlway passage leading into small dome-rooms. At no point in the cave is one able to stand up completely, as the highest ceiling in the cave is about 5 feet above the floor. The first 50 to 60 feet of cave passage is floored with pack rat (*Neotoma cinerea*) droppings and cactus spines common to caves in this area. Fortunately, the further into the cave, the sparser the rat droppings and cactus spines become.

"Premonition" Cave contains few items of interest. Overall, the cave is rather dry and devoid of speleothems, although there are a few small, scattered stalactites and some popcorn. Temperature was 48° F and relative humidity 97%. No bats or bat sign were observed in this cave. There were, however, abundant cave crickets on the walls and ceiling.

NAME: Big Ice Cave

LOCATION: Sec.3, T.8S, R.27E

USGS QUAD: Big Ice Cave, MT - 7½'

LAND OWNERSHIP: U.S. Forest Service

ELEVATION: 7,530 feet

Big Ice Cave is located near the top of the west rim of Cave Canyon. The cave location is shown on the USGS 7½' quadrangle map and the entrance is close to the main road leading to the top of East Pryor Mountain. The cave was at one time semi-commercialized by the U.S. Forest Service.

Big Ice Cave's entrance is a horizontal opening 10 feet high and 20 feet wide at the base of a small cliff (Figure 6, Appendix A). This opening leads into a very large room 150 feet long by 60 feet wide and 15 feet high, which is floored with a thick layer of permanent ice. On the northeast side of this room is an alcove measuring about 30 feet wide by 60 feet long, 8 feet high. At the rear of the main room a passage leads downward for about 120 feet. This passage is completely encrusted year-round with delicate ice crystals, and has been permanently gated to prevent damage to the ice formations.

Big Ice Cave was visited by the authors on March 18, 1992. The alcove off the northeast side of the main room contained some very nice ice speleothems, including columns, stalactites, and stalagmites. During the summer these ice formations melt. At the time of our visit there was quite a bit of water dripping from the ceiling in this area.

During our trip into Big Ice Cave on March 18, 1992, we found two Plecotus townsendii roosting in the cave. These bats were in the alcove off the northeast side of the main room. They were roosting on the ceiling about 3 feet apart, 4 feet above floor level. The temperature was 31° F with a relative humidity of 100%. No Myotis sp. were observed in Big Ice Cave.

The lower passage leading down out of the main room may have contained bats, but due to the permanent gate blocking the passage it was not possible to check this area. The construction of this gate does not allow easy passage for bats in flight.

NAME: Little Ice Cave

LOCATION: Sec.18, T.8S, R.28E

USGS QUAD: East Pryor Mountain, MT - 7½'

LAND OWNERSHIP: U.S. Forest Service

ELEVATION: 8,180 feet

Its name notwithstanding, Little Ice Cave is the largest known cave in the Pryor Mountains, having at least 3,000 feet of passage. The actual amount of passage is open to debate and is probably between 4000 and 5000 feet. The reason for the confusion is that a complete map of the cave does not seem to exist at this time. Reportedly 1,000 feet of previously unmapped passage was surveyed by the Northwest Cave Research Institute (NCRI) during the summer of 1991.

The cave is located in heavy timber just below the east rim of Lost Water Canyon. The cave location is marked on the USGS 7½' quadrangle map. The horizontal entrance alcove, 20 feet wide and 8 feet high, leads into a large, low-ceilinged room (3 to 4 feet average height) floored with permanent ice. It is much more difficult to find this cave in the winter than in the summer, because the road leading to the cave is usually snowed over and difficult to find.

The cave consists of a maze of passages and rooms formed on three levels. A new map of this cave was surveyed during this study, including the upper level passages (Figure 7, Appendix A). The middle, or entrance level includes the entrance room, another large room just beyond, about 200 feet of "canyon-type" passage with narrow walls and high ceilings, and a few short side leads. The lower level is made up chiefly of relatively large walking passage and rooms with ceiling heights of up to about 20 feet. There are also several crawling-sized leads on this level, which may contain significant amounts of passage. The 1,000 feet mapped by NCRI is probably in this area. The upper level contains quite a bit of passage, some of which is negotiated by crawling, and some by walking. There are also a few good-sized rooms on this level, with the largest measuring 40 feet long by 40 feet wide and 15 feet high.

Although scattered areas of speleothem growth do occur, for the most part Little Ice Cave is dry and devoid of speleothems. Most passages are floored either with breakdown or with a mixture of small rocks and dust, although some passages, especially in the upper level, are floored with red clay. There are many marine fossils embedded in the walls and ceilings of the cave. These include horn corals, bryzoans and spiriferoid brachiopods (Campbell 1978).

When we visited Little Ice Cave on March 21, 1992, the two large entrance rooms contained some spectacular ice formations.

About 40 feet inside the entrance the cave ceiling was covered with delicate ice crystals up to 4 inches in length. These crystals covered a ceiling area of approximately 15 feet by 20 feet. Just beyond the point where the permanent ice on the floor ends (the beginning of the 2nd large room), we encountered an impressive grouping of ice stalactites, stalagmites, and columns. The ice stalagmites were particularly impressive, averaging 2½ to 3 feet in height, with several approaching 16 inches in diameter.

No Plecotus townsendii were observed in Little Ice Cave. However, a total of 45 Myotis sp. were seen hibernating in various areas throughout the cave (Figure 7, Appendix A). M. sp. were observed on all three cave levels. Psychrometer readings varied from 35° F db/ 84% to 41° F db/ 86%, with the average reading being 40° F db/ 86%. The lowest reading was taken in the center of the second large room after one enters the cave. This is the room which contains most of the large ice speleothems, however, these speleothems are limited to the extreme western edge of this room, where the temperature was 32° F. There were three M. sp. on the ceiling of this room at a height of about 15 to 20 feet. These M. sp. were roosting in an open area at an average distance of 18 inches apart. While taking psychrometer readings here, two of these bats awoke and took flight.

Three different groupings of Myotis sp. were observed in the upper level of Little Ice Cave. The first group encountered was a group of four bats hanging from the ceiling of the main upper level crawlway just beyond the 'pit' room. These four M. sp. were in one tightly packed cluster, about 4 feet above the floor in an open area. Temperature here was 40° F and relative humidity 86%.

The second group of Myotis sp. encountered on this level was a tightly packed cluster of 28 bats. These bats were also in the main upper level passage, about 75 feet further into the cave than the previous group. This tightly packed cluster of M. sp. covered a ceiling area of approximately 5 by 7 inches, and were about 5 feet above the cave floor. Without disturbing any of these bats, we were able to discern three bats that were banded. The color of these bands was blue (two) and white (one). These bats were most likely banded by Worthington during his two summers of field study in the Pryors (Worthington and Ross 1990, Worthington 1991). Psychrometer readings here were 40° F db/ 86%.

Continuing further into the main upper level passage, we checked a small side passage containing three Myotis sp.. These bats were roosting on an open area of wall at a height of about 3 feet above the floor. Two of the M. sp. were nestled together, while the third was separated from the others by a distance of about 16 inches. Temperature here was 41° F at 86% relative humidity. No more bats were seen on the upper level. We found this level fairly easy to check for bats because average ceiling heights are low and there were only a few inaccessible areas.

Five Myotis sp. were seen on the lower level, at a point about 75 feet from the end of the main lower level passage. These five bats were roosting in a tight cluster on an open area of ceiling at a height of about 15 feet. Temperature here was 40° F and relative

humidity 86%. The lower level of Little Ice Cave contains some areas with fairly high and inaccessible ceilings, which may have harbored more bats.

While we checked the entire cave shown on the accompanying map (Figure 7, Appendix A), plus a few side passages not shown, there were some side passages not shown on the map which could not be checked due to time constraints. There is a good possibility that significant number of additional bats could be using these passages.

The cave apparently receives quite a bit of summertime bat use (Worthington and Ross 1990, Worthington 1991), and we expected to find more bats here than we did, since the temperature and relative humidity of the cave were similar to that of Mystery Cave, which receives heavy winter use as a hibernaculum.

NAME: Mystery Cave

LOCATION: Sec.21, T.8S, R.28E

USGS QUAD: Mystery Cave, MT - 7½'

LAND OWNERSHIP: Bureau of Land Management

ELEVATION: 7,820 feet

Mystery Cave is the second largest cave in the Pryor Mountains. Campbell gives its length as 1,646 feet in Caves of Montana. However, there is more passage that is not shown on his map which may not be counted in this length figure. The cave is marked on the USGS 7½' quadrangle map. The entrance is a 20 foot wide by 8 foot high horizontal opening lying in moderately heavy timber, consisting chiefly of pines and firs. The cave opens immediately into a very large entrance room, the floor of which slopes steeply downward (Figure 8, Appendix A). This room averages 60 feet wide by 100 feet long with ceiling heights of up to 80 feet. At the bottom of this room passages lead off to the east and west.

To proceed west, you climb up to a balcony level overlooking the large entrance room. From this balcony a network of mostly northwest-trending passages lead off. Several of these passages interconnect. Most are of walking size, with ceiling heights averaging about 8 feet but extending as high as 30 feet. Floors in this area are comprised mainly of sand, red clay, small rocks, or flowstone. There are some very nicely decorated areas in this section of the cave, with stalactites, stalagmites, flowstone and popcorn being quite common. Some of these formations are wet and active, others are dry. We would estimate the percentage of formations that are active at about 40%. Most of this part of the cave is fairly dry, with small amounts of dripping and flowing water occurring in the areas of active speleothem growth.

The passage that trends eastward from the bottom of the large entrance room is impressive. It is about 400 feet long and ranges in width from 15 to 50 feet. Ceiling heights average around 30 feet. Most of this corridor is floored with large breakdown blocks. Water drips from the ceiling in many places throughout this passage, but there are only a couple of small, shallow pools of standing water. The largest of these pools is about 1 foot by 2 feet, and 2 inches deep. Speleothems are found throughout the length of this corridor. Very nice draperies and flowstone and many small stalactites adorn the ceiling. Much of the breakdown is coated with flowstone and dripstone. Near the end of this passage is a large alcove containing numerous small soda straws. We estimated about 90% of the formations in this part of the cave are wet and active. Overall, the speleothems in Mystery Cave are in good condition and show very little evidence of vandalism.

An additional 150 to 200 feet of passage leading southeast

from the end of the main corridor is not shown on Campbell's map (Campbell 1978). This passage averages 15 feet wide by 5 feet high and is dryer, with few speleothems.

It has been known for some time that Mystery Cave harbors a large population of bats in the summer months, and that the cave is the major hibernaculum for bats wintering in the Pryors. Far more bats were observed here than in any other Pryor Mountains cave.

We entered Mystery Cave on March 20, 1992 and roughly estimated a total of more than 500 bats. Of these, only three were Plecotus townsendii, the vast majority of the remainder being of the Myotis sp. It was impossible to get an exact count because the majority of the bats seen (over 450) were concentrated near the end of the large east-trending passage, roosting high above the cave floor, and these M. sp. were grouped in tightly packed clusters. The tight packing made counting difficult because bats were often so tightly grouped that it became difficult to tell one from another and often the bats would layer over each other, obscuring those below.

By counting the number of bats in a couple of closer clusters (7 to 8 feet above floor level), we were able to get a rough idea of how many bats could fit into clusters of various sizes. The average cluster size was estimated at 30 bats, but clusters ranged in size from 3 to over 60. Most of these groups were on open ceiling areas 15 to 30 feet above the cave floor. However a few were as low as 5 or 6 feet above the floor. About 95% of the bats in this area were not accessible for close observation. While counting some of the bats in the lower clusters we noticed that a few were banded. These were probably banded by Worthington during the summers of 1989 and 1990 (Worthington and Ross 1990, Worthington 1991). We observed one green band and two red bands. There may have been many more banded bats here that could not be seen inside the tight clusters. Psychrometer readings in this area were 40° F db/ 86%.

A total of 34 Myotis sp. were observed in the southeast trending passage off the main corridor, in clusters of 17, 9 and 7, plus a lone Myotis. The three clusters of 17, 9 and 7 were distributed over about 40 linear feet of passage and were all 4 to 5 feet above the cave floor, on open ceiling or wall areas. We noticed several banded bats here, the colors being: green (two), orange (two), and red (one). A lone M. sp. was in a small alcove about 5 feet above the cave floor, on an area of open ceiling. Temperature in this area was 42° F, relative humidity 86%.

Three Plecotus townsendii were observed in a small alcove in the passage leading to the upper level. They were roosting singly, spaced an average of 12 inches apart. They were on an area of open ceiling/wall approximately 3 feet above the floor. Psychrometer readings here were 38° F db/ 85%.

Five Myotis sp. were observed in the northwestern section of Mystery Cave, also known as the upper level. These were located in what we would call the main northwest-trending passage on this level. Of these, four were roosting in a cluster on an open, smooth ceiling area inside a good-sized dome in the passage

ceiling. The bats were at a height of about 12 feet above the cave floor.

About 50 feet to the southeast in the same passage a single bat was roosting. This bat was on the wall at a height of 6 feet, on an open, smooth area. This bat was tentatively identified as a Myotis evotis, or Long-Eared Myotis, using the key (Barbour and Davis 1969). Psychrometer readings were 41° F db/ 89%.

At the end of a side passage leading southwest from the upper level, a single bat was observed on the wall about 6 feet above the floor inside a smooth-walled ceiling dome. This bat was much larger than the other bats observed and was identified as an Eptesicus fuscus. No psychrometer readings were taken at this location.

Additional Area Caves

During the course of this study, the authors located or attempted to locate a number of the other caves in the area not previously mentioned in this report. Our efforts achieved only a modest rate of success. A reconnaissance of part of Big Pryor Mountain was made from March 10 through the 14th, 1992, using ski and foot travel. All caves and sinkholes marked on USGS topo maps for this area were found to be snow plugged or just not found. Average snowpack on Big Pryor Mountain during this time was estimated at 18". Nearly all of this area is very open tundra-like country with little or no timber cover.

We were unable to find two of the well known caves on Big Pryor Mountain, Crater Ice Cave at an elevation of 8690 feet and Red Pryor Ice Cave at 7900 feet, both on USFS land. It is unlikely that these high elevation caves contain hibernating bats since they commonly fill with snow and ice over the entire winter season.

A number of caves were located and evaluated during the search and several of them were mapped.

- ▶ We reached a large, unnamed sinkhole which Newell Campbell had spotted on Big Pryor Mountain from the air during the summer of 1991. This sink is located on the northeast rim of the head of Sage Creek Canyon, elevation 8200 feet, on USFS land. We descended the sink to about -25 feet on rope. There were no side passages at the perimeter of the sink, although a large snow and ice plug filling the center may cover a cave entrance through breakdown blocks. Measuring 50 by 90 feet, the sinkhole is hard to miss.
- ▶ Another cave was found while skiing the north rim of Big Pryor Mountain. A melt area in a depression of loose rocks attracted our attention. On closer scrutiny we found air blowing from between these rocks. After digging for an hour, we uncovered a tight (2 feet wide) fissure blowing an increased amount of air. Mark Madson rappelled the pit/fissure to a depth of approximately 100 feet to a point where downward progress was difficult. Further exploration was halted. A return trip in summer months is in order. The name "**Freaky Fissure Cave**" seemed appropriate (Figure 16, Appendix A). It is located on USFS land at an elevation of 7720 feet.
- ▶ Two small caves on Big Pryor Mountain were found on March 13, 1992. "**Snowbank Cave**" at 7400 feet elevation on USFS land, had four entrances near the top of a 150 foot cliff. One-hundred eighteen feet of passage was surveyed (Figure 14, Appendix A). No speleothems or bats were observed. "**Belay Cave**" at elevation 7280 feet is several hundred yards down ridge from "Snowbank Cave". A 4 by 8 foot entrance 20 feet down from the top of a 100 foot cliff leads to 46 feet of surveyed passage (Figure 11, Appendix A). No speleothems or

bats were observed.

- ▶ On East Pryor Mountain, two large shelter caves were found while pursuing a lead from Newell Campbell. Both are shelter caves connected to the ridge top above via 40 foot pits. Neither contain speleothems or bats but may contain archeological significance. Named "**Chimney Cave**" and "**Skylight Cave**", both are on BLM land at elevations of 6060 feet and 5760 feet, respectively (Figures 12 and 15, Appendix A).
- ▶ Salt Lick Cave was located and entered by digging into a tight crawl through a snow tube on the left edge of the entrance drift plug. The cave was as described in Caves of Montana and contained no bats.

All caves mentioned previously in this section are located on quadrangle site maps in Appendix C of this report.

Mines in the Study Area

Most of the old mine shafts and tunnels in the Pryors are relics of a rush for uranium prospects in the '40's and '50's. All now abandoned, they present potential roost sites. In light of this, the authors investigated mines encountered on the southern extension of Big Pryor Mountain called Red Pryor Mountain.

Mines visited were the **Lisbon**, **Dandy**, **Swamp Frog**, **Marie**, **Sandra** and **Old Glory**. The **Lisbon** and **Dandy** mines contained hibernating bats and are detailed in this report. Sketch maps showing bat locations and temperature/ relative humidity readings appear in Appendix A. Around the same elevation as the **Dandy Mine** and comparable to the **Dandy** in extent and temperatures, the **Marie** contained no bats. The **Sandra** is a tunnel 8 by 10 feet and 150 feet long, containing timber shoring for most of its length. No bats were observed, although they may roost between the shoring and tunnel walls. The **Swamp Frog** main adit was sealed and several adits nearby provide insufficient passage for a thermally stable winter roost. The **Old Glory** was extensive and interesting, intersecting crystal-lined cavities, but produced no bats and should not be entered in the future due to the extremely unstable condition of the mine.

Mine Descriptions

NAME: Dandy Mine

LOCATION: Sec.9, T.9S, R.27E

USGS QUAD: Red Pryor Mountain, MT - 7½'

LAND OWNERSHIP: Bureau of Land Management

ELEVATION: 6,090 feet

Visited on March 4, 1992. Outside temperature was 5° F. The Dandy Mine claim consists of two main adits. The east adit is too short to provide sufficient thermal insulation for habitation. The west adit proved rather maze-like. Passage direction was influenced by the intersection of numerous natural cavities (Figure 9, Appendix A). Passage dimensions vary considerably as a result. There were three distinct levels to the mine. The lowest level is flooded with water. Four Plecotus townsendii and one Myotis sp. were observed on our visit. The first two P. townsendii were roosting on the ceiling, 4 feet apart and 7 feet above the floor. Temperature near them was 41° F and relative humidity 100% in this mid-level alcove. One M. sp. was found in passage below the alcove on the ceiling, 9 feet above the floor. Temperature was 42° F and relative humidity 100%. The two remaining P. townsendii were found on the mid-level near an alcove covered with a two inch layer of large calcite crystals. Temperature here was 40° F and relative humidity 100%.

NAME: Lisbon Mine

LOCATION: Sec.4, T.9S, R.27E

USGS QUAD: Red Pryor Mountain, MT - 7½'

LAND OWNERSHIP: Bureau of Land Management

ELEVATION: 6,600 feet

Visited on March 4, 1992. Outside temperature was 5° F. The Lisbon Mine claim originally consisted of two or perhaps three adits, although only one is still open. This consists of a straight tunnel trending north, approximately 200 feet long with an average width and ceiling height of 10 feet (Figure 10, Appendix A). The entrance area is fenced off. Ten Myotis sp. and one Plecotus townsendii were observed on our visit. Thirty feet inside the entrance, two M. sp. were found tucked into a ceiling crack. Temperature nearby was 45° F and relative humidity 87%. Sixty feet further, one M. sp. was found securely crammed inside a drill hole. Only the top of the head and ears were visible.

Midway, the tunnel expands to 15 by 20 feet for a length of 30 feet. Five Myotis sp. were found behind large rock flakes, high (9 feet) on the west wall. One Plecotus townsendii was observed roosting 7 feet up on the opposite wall. Temperature at this location was 44° F and relative humidity 100%. The last two M. sp. were located 30 feet apart, both roosting 7 feet up on the tunnel walls in small vugs or pockets. Temperature near the farthest bat was 44° F and relative humidity 93%.

CONCLUSIONS

Mark Madson wants to add these.

Give him a call.

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Greg Hanson and Mark Madson

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APPENDICES

- A. FIGURES AND MAPS**
- B. CAVE INVENTORY FORMS**
- C. CAVE LOCATION MAPS**

APPENDIX A
FIGURES AND MAPS

<u>Figure #</u>	<u>Description</u>
1	List of Bats Found in Montana
2	Map of Pryor Mountain Study Area Showing Major Caves and Mines
3	Map of Four-Eared Bat Cave
4	Map of Syke's Cave
5	Sketch Map of Royce Cave
6	Map of Big Ice Cave
7	Map of Little Ice Cave
8	Map of Mystery Cave
9	Map of Dandy Mine
10	Map of Lisbon Mine
11	Map of "Belay" Cave
12	Map of "Chimney" Cave
13	Map of "Premonition" Cave
14	Map of "Snowbank" Cave
15	Map of "Skylight" Cave
16	Sketch Map of "Freaky Fissure" Cave
17	Profile Map of Frogg's Fault Cave
18	Foldout Map of "New" Section of Frogg's Fault Cave
19	Foldout Profile Map of "New" Section of Frogg's Fault Cave
20	Foldout Map of Frogg's Fault Cave (complete)
21	Foldout Map of Four-Eared Bat Cave
22	Foldout Map of "Rolls" Cave

FIGURE 1

LIST OF BATS FOUND IN MONTANA ¹

Scientific Name	Common Name	Observed in the Pryors	Observed During This Study ²
<i>Antrozous pallidus</i>	Pallid Bat	Yes	
<i>Eptesicus fuscus</i>	Big Brown Bat	Yes	Yes
<i>Euderma maculatum</i>	Spotted Bat	Yes	
<i>Lasionycteris noctivagans</i>	Silver-Haired Bat	Yes	
<i>Lasiurus cinereus</i>	Hoary Bat	Yes	
<i>Myotis californicus</i>	California Myotis		
<i>Myotis ciliolabrum (leibii)</i>	Western Small-Footed Myotis	Yes	
<i>Myotis evotis</i>	Long-Eared Myotis	Yes	Yes
<i>Myotis septentrionalis</i> (keenii)	Keen's Myotis		
<i>Myotis lucifugus</i>	Little Brown Myotis	Yes	
<i>Myotis thysanodes</i>	Fringed Myotis		
<i>Myotis volans</i>	Long-Legged Myotis	Yes	
<i>Myotis yumanensis</i>	Yuma Myotis		
<i>Plecotus townsendii</i>	Townsend's Big-Eared Bat	Yes	Yes

¹ Data from Thompson, L.S., "Distribution of Montana Amphibians, Reptiles and Mammals," Montana Audubon Council, 24 pages, 1982, and Worthington, D.J., "Abundance and Distribution of Bats in the Pryor Mountains of South Central Montana and North Eastern Wyoming", Montana Natural Heritage Program, Helena, Montana, 1991, 23 pp.

² Many individual Myotis sp. were observed from a distance but not fully identified. More individual species were anticipated to hibernate in Pryor Mountain caves than indicated by this study.

APPENDIX B
CAVE INVENTORY FORMS

Big Ice Cave
Four-Eared Bat Cave
Frogg's Fault Cave
Little Ice Cave
Mystery Cave
"Premonition" Cave
"Rolls" Cave
Royce Cave
Syke's Cave

APPENDIX C

CAVE LOCATION MAPS

Section of Big Ice Cave quadrangle - locating Big Ice Cave

Section of Pryor Mountain quadrangle - locating Little Ice Cave and Salt Lick Cave

Section of Indian Springs quadrangle - locating "Freaky Fissure" Cave

Section of Indian Springs quadrangle - locating "Belay" Cave and "Snowbank" Cave

Section of Mystery Cave quadrangle - locating Mystery Cave

Section of Mystery Cave quadrangle - locating "Chimney" Cave, Frogg's Fault Cave, "Premonition" Cave, Royce Cave, and "Skylight" Cave

Section of Mystery Cave quadrangle - locating Four-By-Four Cave, Four-Eared Bat Cave, and Syke's Cave

Section of Red Pryor Mountain quadrangle - locating Dandy Mine and Lisbon Mine